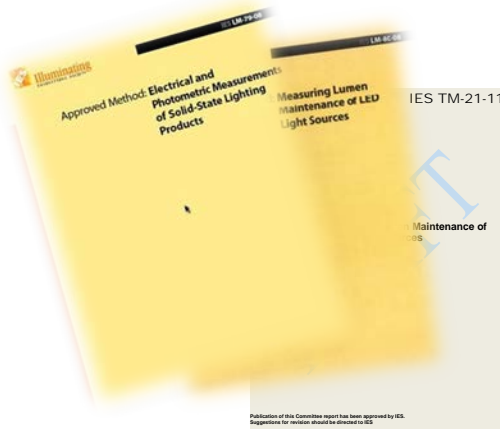
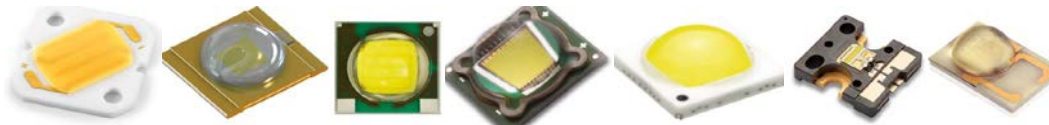
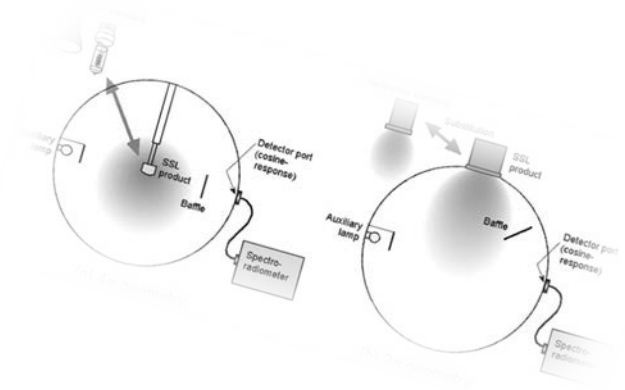


# LED Standards Progress: Focus on Long Term and Application Performance



LightFair 2012  
Eric Richman



## Primary LED Standards and Test Methods in place:

- C78.377 – Chromaticity for comparison and matching
- RP-16 - Definitions
- LM-79 - Photometric and Electrical performance
- LM-80/TM-21 - Lumen Degradation related to “life”
- UL8750/UL1598 – Safety (including retrofit kits)
- NEMA SSL-1 and 6 - Basics of LED Drivers/Dimming
- LM-82 – Testing lamps/light engines at temperatures

....currently much focus within the industry on **long term performance** (life claims, reliability, application)

## ....is ultimately a reliability issue

Historically (for traditional lighting).....

*Lighting Reliability = Lamp Life*

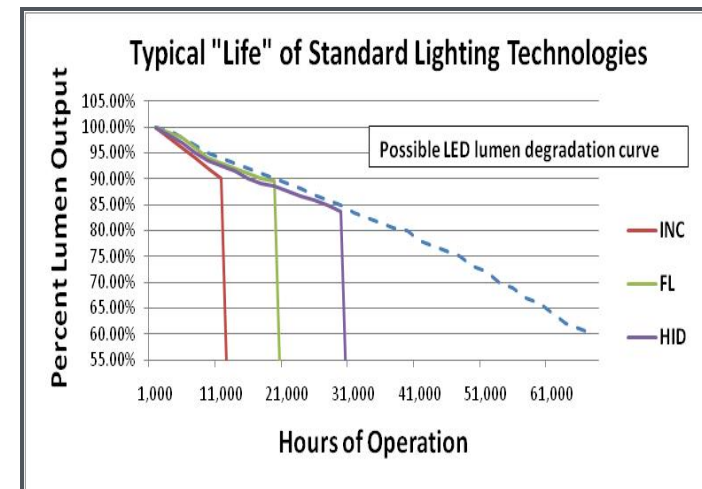
- Lamp failure is well established as critical lighting reliability component (shortest life)
- Fixture and Ballast not typically considered as their expected life is relatively long
- Lamps separately measurable from other components – easy target for life

....Other characteristics such as color and lumen degradation have generally been accepted

# ...along comes LED technology

- LED “lamp” no longer a short life item – will realistically degrade over long periods of time
- Potential long life of LEDs forces critical look at other components and performance
  - Driver (ballast) and electrical circuitry
  - Fixture parts and operation (i.e. dimming)
  - Color?

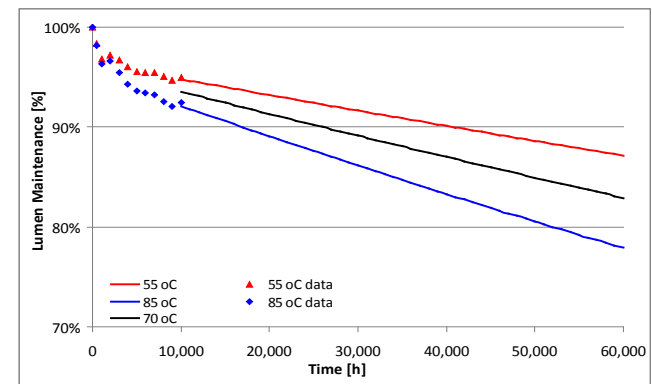
*True (LED) life = Total Luminaire Reliability*  
...so where are we now and where to go from here?



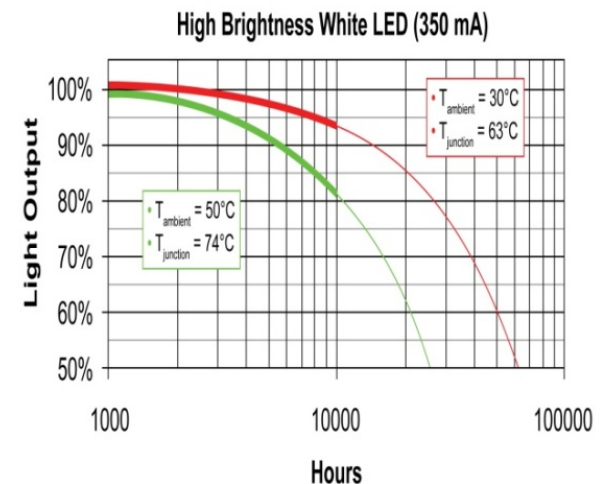
- LM-80 Provides format for measurement of lumen degradation (min 6,000 hrs)
- Covers LED packages, arrays and modules only
- TM-21 defines a method for estimating future lumen degradation – considered one metric of product “life”.



....LM-80/TM-21 does not present a complete reliability metric – but is one part of the puzzle!



- LM-82 provides a method for testing LED products at different expected operating temperatures.
- Covers LED lamps and light engines which are both used in wide varieties of fixtures
- Provides luminaire developers needed information for determining and presenting product performance for better product application
- Supports simpler testing for multiple product configurations



- DOE/NGLIA task force on SSL Luminaire Lifetime
  - Second edition report is available.  
([http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led\\_luminaire-lifetime-guide\\_june2011.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led_luminaire-lifetime-guide_june2011.pdf))
  - Provides information on the issues of complete system reliability and suggests appropriate testing and reporting
- IES – test methods in development
  - **Reliability rating method (TM-26)** - Seeks to develop a combined metric that represents lumen degradation and failure modes for LEDs to more truly represent reliability
  - **Lumen maintenance of LED luminaires (WG-8)** – Seeks to identify an effective method for projecting long-term lumen maintenance of complete LED luminaires

## Product Listings:

- Energy Star (<http://www.energystar.gov/>)
- Design Lights Consortium (DLC) (<http://www.designlights.org/>)

## Application Specifications:

- Commercial Building Energy Alliance (CBEA)  
(<http://www1.eere.energy.gov/buildings/alliances/technologies.html>)
  - Parking Structure
  - Site Lighting
  - High-Efficiency Troffer
  - Refrigerated Display Case Lighting

## Technical Information and Design Guidance:

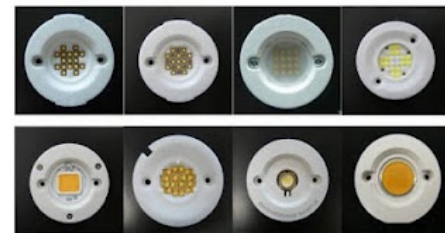
- DOE SSL Technical Information/Fact Sheets/GATEWAY
- IES LED Application Guide (G-2) (<http://www.ies.org/store/>)

.....A growing issue in the industry



- NEMA has explored the issue with white papers (<http://www.nema.org/stds/lcd.cfm>) :
  - NEMA LSD 44—Solid State Lighting—The Need for a New Generation of Sockets and Interconnects
  - NEMA LSD 45—Recommendations for Solid State Lighting Sub-Assembly Interfaces for Luminaires
- Zhaga Consortium has produced several voluntary specifications for the physical connection of light engines (<http://www.zhagastandard.org/>)

.....Much more work needed



# The process still needs your support.....

Current standards and New standards need champions, drivers, and reviewers!

## Questions?